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# Three new species and a new genus of Farreidae (Porifera: Hexactinellida: Hexactinosida)

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*Abstract.*—Two new species of *Farrea* and a single new species of a closely related new genus, *Asceptrulum,* all members of the hexactinosan family Farreidae, are described from three widely distant locations. *Farrea herdendorfi,* new species, with a type series of eight specimens obtained from 2200 m off Charleston, South Carolina, U.S.A., NW Atlantic Ocean, is distinguished by two anchorate clavule forms (umbellate and thimblate or thimble-shaped), both without spiral arrangement of claws. *Farrea seiri,* new species, represented by 3 fragments of a single specimen from 1450 m near the South East Indian Ridge, mid Indian Ocean, is characterized by only anchorate clavules of thimblate form, a moderate proportion of which have claws spiralled. *Asceptrulum axialis,* new genus, new species, is represented by several fragments from a single specimen collected from 2387 m on the Juan de Fuca Ridge, northern Oregon, U.S.A., NE Pacific Ocean. It is distinguished by the combination of complete absence of sceptrules and a one-layered farreoid framework. The diagnosis of Farreidae is emended to encompass the new genus.

Although recognized 132 years ago, hexactinellid sponges, more familiarly referred to as "glass sponges", are still obscure members of the deep sea invertebrate fauna. Members of the dictyonine family Farreidae Gray are among the most commonly encountered hexactinellids, distributed mainly on continental shelves and slopes, but extending into deep water to over 5200 m depth. This hexactinosan family presently includes 21 species distributed unevenly in 5 genera, 17 of those in the genus *Farrea.* The most recent family diagnosis (Reiswig 2002) focused on one class of free spicules, sceptrules, which here consist of at least one form of clavule or sarule, with or without lonchiole or aspidoscopule. Forms with narrow-head scopule were excluded from the family. A second common feature of most, but not all, members of the family, not included in that recent diagnosis, is the minimal, one-layered dictyonal framework at the growing margin.

Specimens of three forms, obtained from moderately deep water and submitted to our laboratory for identification, have proven to be undescribed species of this family. Two of them are easily incorporated in the speciose genus *Farrea* Bowerbank, 1862, but the third entirely lacks sceptrules and thus cannot be assigned to a family on the basis of present diagnoses. Its assignment to a new genus erected within Farreidae requires emendation of that family diagnosis, proposed here.

## Materials and Methods

Most submitted specimens (all *F. herdendorfi,* new species, and *Asceptrulum axialis,* new genus, new species) were collected by robot submersible and were accompanied by videotape of the collection process. Only *F. seiri* new species, was collected by dredge.

Small fragments of the sponge body wall were either whole-mounted in Canada balsam for light microscopy (LM), or were dissolved in hot nitric acid. The acid-cleaned skeletal frameworks were removed, rinsed and dried; the remaining spicule suspensions were filtered through 25 mm diameter, 0.2 mm-pore-size, nitrocellulose filters; filters with spicules were thoroughly rinsed with distilled water, dried, cleared with xylene, and mounted in Canada balsam on microscope slides. Characters of frameworks and spicules were measured by computer using a microscope-coupled digitizer. Data are reported as mean ± standard deviation (range, number of measurements). Spicules for scanning electron microscopy (SEM) were similarly nitric acid cleaned, rinsed in distilled water and then directly deposited onto cover glasses mounted on SEM stubs. Acid-cleaned and rinsed fragments of body wall skeletal frameworks were mounted directly on stubs with epoxy. Following gold-palladium coating, specimens were viewed and photographed with a JEOL JSM-840 SEM. Spicule drawings were the made by importing LM or SEM images into a computer image-processing program, and then tracing on screen. Type specimens of the new species have been deposited in the National Museum of Natural History, Smithsonian Institution, Washington D.C. (USNM).

Family Farreidae Gray, 1872

*Diagnosis (emended).*—Hexactinosida typically with sceptrules in the form of clavules, or their derivatives, sarules, lonchioles or aspidoscopules, and typically with a farreoid dictyonal framework. Where sceptrules are lacking the framework is farreoid. Where the framework is euretoid, sarules are present.

*Remarks.*—Emendation of the diagnosis of Farreidae is required for inclusion of the new genus *Asceptrulum* as proposed below.

Genus *Farrea* Bowerbank, 1862

*Type species.*—*Farrea occa* Bowerbank, 1862, by monotypy.

***Farrea herdendorfi***, new species
(Figs. 1–3; Table 1)

*Holotype.*—USNM 1001596; S.S. 'Central America' wreck, 300 km S. of Charleston, S.C., 31.5°N, 77°W, 12 Sep 1989, 2200 m depth, coll. C.E. Herdendorf, R/S 'Nemo' from R/V 'Arctic Explorer', dive UA.

*Paratypes.*—All from above sampling location and vessels; USNM 1001597, USNM 1001600, USNM 1001601, USNM 1001602, USNM 1001603, all 12 Sep 1989, col. C.E. Herdendorf, Dive UA; USNM 1001598, USNM 1001599, 21 Sep 1990, col. B. Evans, dive AC.

*Diagnosis.*—*Farrea* with only anchorate clavules, the heads of which vary between two extreme forms—an umbellate (hemispherical) form and a thimblate (nearly cylindric) form with straight claws nearly parallel to shaft. Shafts of all clavules are rough but lack conspicuous spines.

*Description.*—Size and shape: The holotype is 30 cm in height, with a branching element arising 16 cm above the lower end (base is missing), extending 11 cm at 60° from the primary axis (Fig. 1E). At widest points, the main body and lateral branch are, respectively, 5.0 and 4.2 cm thick. The central body of the sponge is cryptically bilaterally symmetical (see below), composed of an original flat blade or stipe incorporated as one side of an axial tube by medial fusion of lateral undulations or ruffles. Through further lateral extension and tight curvature, the lateral ruffles fuse to form tubes appended onto the axial tube. The diameter of outer exposed tubular apertures of the holotype are 6.7 ± 2.0 mm (range 5–10 mm, n = 12).

A sequence of age/maturation stages is

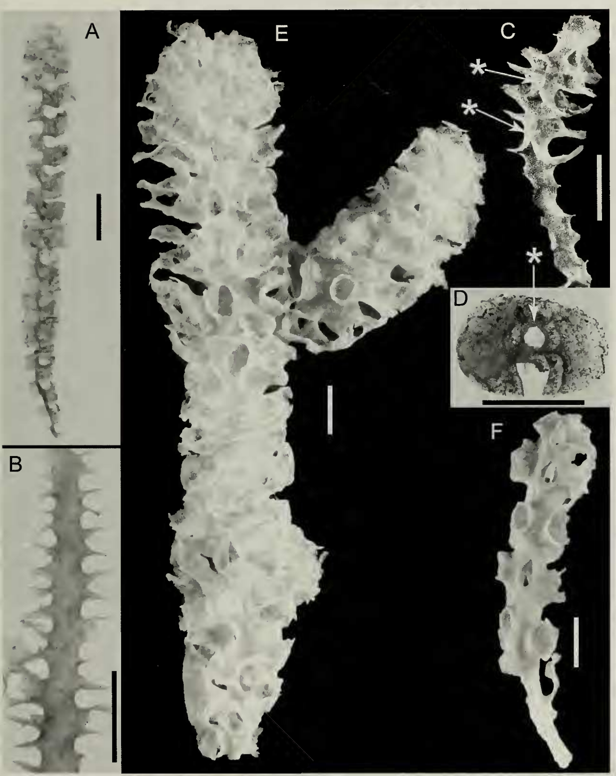


Fig. 1. *Farrea herdendorfi,* new species, body form. A. Paratype USNM 1001601 in lateral view. B. Same in frontal view. C. Paratype USNM 1001602 in frontal view, asterisks indicate fusion points of lateral pleats to form axial tube. D. Same viewed from distal end with axial tube closed by fusion series at asterisk. E. Holotype USNM 1001596, lateral view. F. Paratype USNM 1001597, with thickened walls, in frontal view. Scale bars = 2 cm.

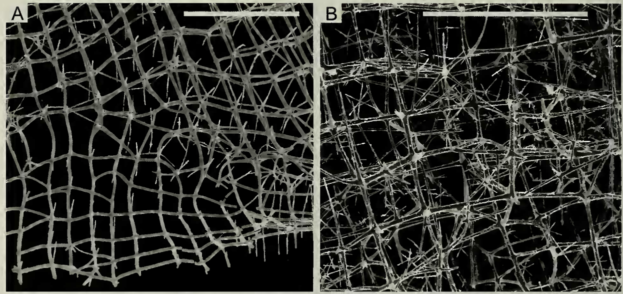


Fig. 2. *Farrea herdendorfi,* new species, framework (SEM). A. Single-layer primary framework in marginal area of paratype USNM 1001601, bearing long, usually straight spurs. B. Thickened main body area of holotype USNM 1001596 with irregular dictyonal layers added on dermal side. Scale bars = 1 mm.

apparent in the type series as inferred from wall thickness and degree of expansion and fusion of lateral edges—from a simple blade to the complex fused structure of the lateral tubes. The simplest paratype available (Figs. 1A, B) is an axial blade, 18.6 cm long, with undulatory expansion of lateral margins as ruffles but without fusion between them. A more complex and older but shorter specimen, 8.2 cm long (Fig. 1C), exhibits logitudinal fusion between ruffles along one side to form an axial tube on the axial blade (Fig. 1D). The holotype (Fig. 1E) exhibits the next stage with fusion and branching of ruffles to form a complex bed of lateral tubes supported upon the axial tube. Beyond the branching point, the axial blade and tube of both extremities arise *de-novo* from the lateral ruffles—continuity does not exist between axial components of the basal axis and the two distal shoots. By wall thickness, paratype CA6, 14.7 cm long, is next oldest of the series (Fig. 1F) but its gross morphology has apparently been simplified by abrasion. It consists of the axial tube bearing only the thick-walled bases of lateral tubes in alternating offset pairs. The marginal ruffles and tubes have apparently been torn off during collection. The oldest specimen, not figured, is an extremely thick-walled and dense basal part, 6.6 × 4.9 cm, of a much larger specimen. That this constructed series of body shapes represents a sequence in growth of a single species is confirmed by identical loose spicules in all specimens.

Framework (Fig. 2, Table 1): The framework is an unchannelized dictyonal lattice, consisting of, in the thinnest-walled (young) specimens and at growing edges of thick-walled (older) specimens, a one-layer, two-dimensional lattice of somewhat irregular rectangular meshwork with easily recognizable longitudinal dictyonal strands (Fig. 2A). Most of the framework of all but the thinnest specimens is augmented by addition of secondary dictyonalia in irregular-mesh network mainly on dermal, but in some places on the atrial side to form a three-dimensional framework (Fig. 2B). Small hexactins attached to beams of primary and secondary dictyonalia are abundant. Wall thickening and increasing rigidity of the framework with aging is due to addition of both more secondary dictyonalia and small hexactins, but only slightly accompanied by thickening of primary dictyonal strands. Spurs are long, thin, rough

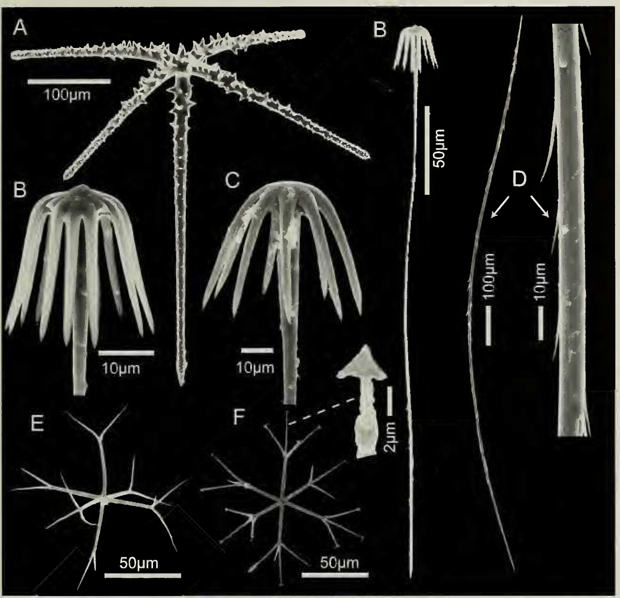


Fig. 3. *Farrea herdendorfi,* new species, spicules of holotype USNM 1001596 (SEM). A. Surface pentactin. B. Thimblate anchorate clavule, whole and head. C. Umbellate anchorate clavule head. D. Uncinate, whole and magnified segment. E. Oxyhexaster. F. Onychexaster with magnified ray tip.

and spine-like, usually straight but occasionally slightly curved.

Spicules (Fig. 3, Table 1): Pentactins (Fig. 3A), lining both dermal and atrial surfaces, have tangential rays heavily spined on outer surfaces, and long proximal ray with heavy spination only on upper third. Uncinates are very long, exceptionally thin and moderately barbed. Two forms of anchorate clavules occur intermixed on both surfaces, both forms having a thin, smooth shaft ending in a slightly rough, bluntly pointed tip. The thimblate (thimble-shaped) form (Fig. 3B) has approximately 15 spines projecting down from a discoid cap, flaring slightly outward at the lower edge. The anchorate form (Fig. 3C) has approximately 10 spines projecting out and down from a smoothly rounded cap, continuing on the angle of curvature without reflexion. Microscleres consist of two types of smooth hexasters distributed throughout the specimen. Oxyhexasters (Fig. 3E) have six long primary rays, each bearing 2–3 secondary rays ending in sharp tips. Onychexasters (Fig. 3F), alternately interpretable as dis-

Table 1.—Spicule and framework dimensions (in μm) of *Farrea herdendorfi*, new species, holotype USNM 1001596, from off South Carolina, USA.

| Item | Mean | St. dev. | Range | N |
|---|---|---|---|---|
| A. Surface pentactin: | | | | |
| tangential ray length | 231 | 29 | 179–299 | 50 |
| tangential ray width | 13.1 | 2.9 | 5.2–20.0 | 50 |
| proximal ray length | 298 | 81 | 141–464 | 50 |
| proximal ray width | 11.2 | 2.2 | 6.6–17.2 | 50 |
| B. Thimblate clavule length | 353 | 75 | 130–490 | 50 |
| head length | 32.7 | 5.5 | 20–45 | 50 |
| head diameter | 34.9 | 7.9 | 19.7–56.2 | 50 |
| C. Umbellate clavule length | 454 | 55 | 313–581 | 50 |
| head length | 36.9 | 4.4 | 29–49 | 50 |
| head diameter | 48.2 | 5.3 | 32–66 | 50 |
| D. Uncinate length | 1368 | 308 | 830–2086 | 50 |
| width | 6.1 | 1.4 | 3.5–9.9 | 50 |
| E. Oxyhexaster diameter | 120 | 13 | 86–146 | 50 |
| primary ray length | 30.7 | 4.6 | 21.6–43.1 | 50 |
| secondary ray length | 33.1 | 4.7 | 20.7–44.3 | 50 |
| F. Onychexaster diameter | 114 | 12 | 87–141 | 50 |
| primary ray length | 27.9 | 3.6 | 22.2–39.7 | 50 |
| secondary ray length | 29.7 | 4.0 | 19.3–37.8 | 50 |
| G. Framework beam length | 352 | 129 | 125–748 | 50 |
| beam width | 28.2 | 9.2 | 14.5–57.7 | 50 |
| H. Framework spur length | 287.0 | 110 | 124–727 | 50 |

cohexasters with reduced discs, have 3–4 irregularly lumpy secondary rays (without sharp spines) each ending in a flat disc with 2–4 short blunt claws.

*Etymology.*—The species is named after the collector of the holotype, Prof. Charles E. Herdendorf, who also served as coordinator of the Adjunct Science and Education Program, S.S. 'Central America' Project, Columbus-America Discovery Group. Gender of the species name is female.

*Remarks.*—Herdendorf et al. (1995) reported this form as "*Farrea* new species" (p. 86) and figured the specimen designated here as holotype being collected (their Fig. 45). The species differs from all known *Farrea* in the form of its clavules. The distinctive thimblate clavule head is most similar to that of form B of *F. kurilensis* (Okada, 1932), but those clavules have coarsely thorned shafts and are accompanied by a pileate clavule not present in *F. herdendorfi.*

## *Farrea seiri*, new species
(Figs. 4, 5; Table 2)

*Holotype.*—USNM 1001594, Southeast Indian Ridge, Indian Ocean, 39°12.83′S, 77°52.88′W, 22 Mar 1996, 1450 m depth, coll. D.S. Scheirer and K. Johnson, Boomerang Expedition, Leg 6, R/V 'Melville', biosample #7, Site 48, Dredge 58, dive# BMRG 06 MV.

*Diagnosis.*—*Farrea* with only anchorate clavules, all thimblate in form without shaft spines. The most abundant clavule type has straight claws while the less common form has claws spiralled either dextrally or sinestrally.

*Description.*—Size and shape: The holotype and only sample consists of three

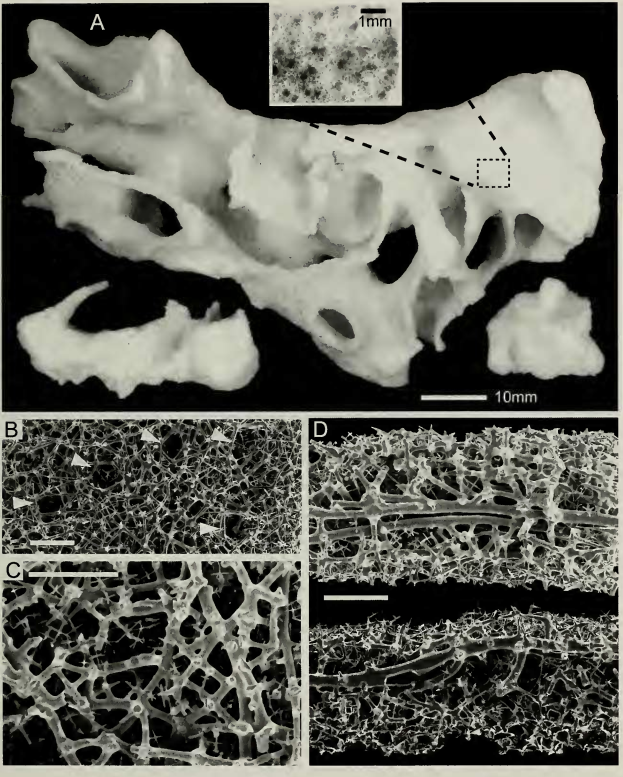


Fig. 4. *Farrea seiri,* new species, body form and framework of holotype USNM 1001594. A. Body form with epirhyses evident in magnified inset. B. Outer surface with shallow epirhyses indicated by arrowheads (SEM). C. Probable primary layer in middle frontal layer of framework exposed by dissection (SEM). D. Two transverse sections of body wall showing thickened main longitudinal strands deep within framework (SEM). Scale bars = 0.5 mm.

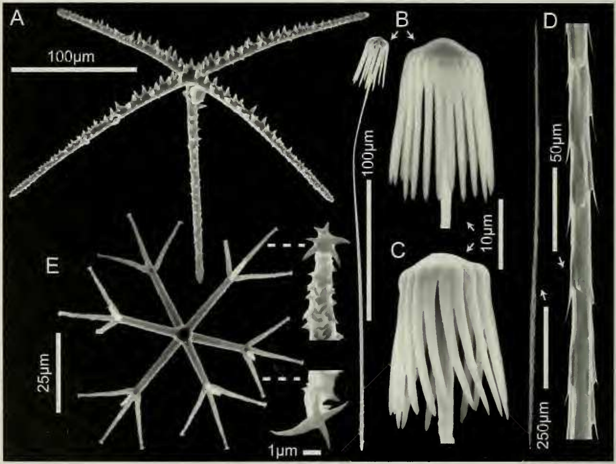


Fig. 5. *Farrea seiri,* new species, spicules of holotype USNM 1001594 (SEM). A. Surface pentactin. B. Straight thimblate anchorate clavule, whole and head. C. Spiral umbellate anchorate clavule head. D. Uncinate, whole and magnified segment. E. Onychexaster with magnified ray tips.

very stout fragments from the basal part of a single specimen (Fig. 4A). The specimen was severely damaged during dredge collection, all distal parts with thin body wall having been lost. The largest fragment measures 9.6 × 4.3 cm, the second largest 3.9 × 1.5 cm, and the smallest 1.8 × 1.7 cm. All fragments are white in colour, with fairly thick walls (for Farreidae), 2.08 ± 1.04 mm (range 0.95–3.80 mm, n = 10), though all are quite fragile, easily crushed and crumbled.

The main fragment is composed of two fused tubes, the younger attached obliquely along the side of the older. The older tubular element provided basal attachment for the specimen and was dead at the time of collection. The younger tube has a series of lateral openings arranged in sets of two in alternating offset pairs, aperture length 9.2 ± 0.9 mm (range 8.3–10.4 mm, n = 5) width 5.1 ± 0.9 mm (range 4.1–7.0 mm, n = 5). Attempts to map dermal and atrial surface topology showed that there is no consistent distinction between surfaces relative to tubular walls.

Framework (Fig. 4, Table 2): The outer layers of the rigid dictyonal framework (Fig. 4B), are composed of a highly irregular mesh of hexactins, many with polyradial nodes, outlining shallow extradictyonal epirhyses and aporhyses as surface pits (Figs. 4A insert, 4B). Pits have ovoid apertures, length 0.33 ± 0.038 mm (range 0.26–0.38 mm, n = 8), width 0.24 ± 0.045 mm (range = 0.18–0.32 mm, n = 8). Distances between pits 0.66 ± 0.18 mm (range 0.33–1.20 mm, n = 32).

Beam thickening has occurred throughout the entire specimen, and there is no sin-

Table 2.—Spicule and framework dimensions (in μm) of *Farrea seiri*, new species, holotype USNM 1001594, from mid Indian Ocean.

| Item | Mean | St. dev. | Range | N |
|---|---|---|---|---|
| A. Surface pentactin: | | | | |
| tangential ray length | 155 | 37 | 67–253 | 50 |
| tangential ray width | 8.1 | 2.6 | 3.9–12.5 | 50 |
| proximal ray length | 193 | 68 | 99–379 | 50 |
| proximal ray width | 7.9 | 2.3 | 3.1–13.3 | 50 |
| B. Straight clavule length | 243 | 36 | 184–347 | 50 |
| head length | 27.3 | 4.9 | 16.3–39.3 | 50 |
| head diameter | 17.0 | 3.8 | 12.8–29.5 | 50 |
| C. Spiral clavule length | 265 | 36 | 182–345 | 50 |
| head length | 29.7 | 4.3 | 21.0–39.3 | 50 |
| head diameter | 21.4 | 3.4 | 13.4–28.1 | 50 |
| D. Uncinate length | 802 | 376 | 520–1610 | 8 |
| width | 6.5 | 2.5 | 3.3–10.1 | 8 |
| E. Onychexaster diameter | 91 | 11 | 72–117 | 50 |
| primary ray length . | 26.2 | 4.0 | 18.7–35.5 | 50 |
| secondary ray length | 21.9 | 3.7 | 13.2–29.0 | 50 |
| F. Framework beam length | 287 | 107 | 89–503 | 50 |
| beam width | 51 | 16 | 22–96 | 83 |

gle layer which can be identified as a buried farreoid two-dimensional grid (Fig. 4C). Long stretches of smooth dictyonal strands located deep within the wall (Fig. 4D) are hypersilicified, obscuring original hexactins. Both outer and inner meshes are further obscured by large numbers of small intercalated hexactins. Spurs are moderately common on both surfaces, and within the internal meshwork, but these are not directly comparable to spurs on the primary dictyonalia of other farreids.

Spicules (Fig. 5, Table 2): Pentactins have strong spination on outer surface of tangential rays, extending almost to the tips (Fig. 5A). The proximal ray is heavily spined near the centrum, and entirely rough throughout its length. Clavules are all anchorate and thimblate in form and occur in two types, a straight thimblate type (Fig. 5B) and spiro-thimblate type (Fig. 5D). Both have a thin, smooth shaft, ending in a bluntly pointed tip. The head of the straight thimblate type has approx. 25 claws projecting down from a discoid cap, either straight and parallel or flaring slightly outward. The spiro-thimblate type has similar cap and claws, but claws curve distally either to the left (sinistral) or right (dextral). Pentactins and both clavule types occur on all surfaces without distinction. Uncinates are typically long and thin with moderately developed barbs but without a distinguishable centrum (Fig. 5D). The only microsclere type is an onychexaster (Fig. 5E) distributed evenly throughout the specimen. The finely rough primary rays each bear four similarly rough secondary rays, each of which ends in a button margined by 3–6 short, slightly reclined claws.

*Etymology.*—The species name, *seiri*, is formed from the acronym of its collection locale, the Southeast Indian Ridge. Gender of the species name is female.

*Remarks.*—This species is most similar and closely related to *F. herdendorfi* described above, but differs in having only thimblate anchorate clavules and lacking oxyhexaster microscleres. The unavailability of distal portions of the specimen, and

Table 3.—Spicule and framework dimensions (in μm) of *Asceptrulum axialis,* new genus, new species, holotype USNM 1001604, from NE Pacific.

| Item | Mean | St. dev. | Range | N |
|---|---|---|---|---|
| A. Surface pentactin: | | | | |
| tangential ray length | 217 | 29 | 141–279 | 50 |
| tangential ray width | 16.8 | 4.4 | 7.9–25.1 | 50 |
| proximal ray length | 446 | 108 | 261–752 | 50 |
| proximal ray width | 15.1 | 4.5 | 8.6–27.1 | 50 |
| B. Uncinate length | 1641 | 250 | 1173–1967 | 12 |
| width | 10.4 | 2.7 | 5.5–15.2 | 23 |
| C. Discohexaster diameter | 66 | 7 | 53–81 | 50 |
| primary ray length | 10.0 | 1.7 | 6.2–13.5 | 50 |
| secondary ray length | 25.4 | 3.0 | 19.8–31.2 | 50 |
| D. Framework beam length[a] | 346 | 75 | 204–584 | 50 |
| beam width[a] | 43.8 | 9.1 | 28.4–77.7 | 50 |
| E. Spur length[a] | 335 | 79 | 147–528 | 50 |

[a] In marginal areas of framework.

its presumable two-dimensional farreoid framework do not seriously compromise its placement in *Farrea* since its spiculation is compelling evidence of its relationship to other *Farrea* species. Thickness of the basal skeleton and presence of shallow epirhyses and aporhyses are rarely encountered in the genus but are not unique to this species.

### Genus *Asceptrulum,* new genus

*Type species.*—*Asceptrulum axialis,* here designated.

*Diagnosis.*—Farreidae lacking sceptrules.

*Etymology.*—The genus name, *Asceptrulum,* is formed from Greek *a* = without, plus sceptrula, from Greek *skeptron* and Latin *sceptrum* (neuter) = royal wand or staff, in allusion to the absence of sceptrule spicules. Gender of the genus name is neuter.

*Remarks.*—See under species below.

### ***Asceptrulum axialis,*** new species (Figs. 6, 7; Table 3)

*Holotype.*—USNM 1001604: North CoAxial segment, Juan de Fuca ridge, northern Oregon, 46°29.83′N, 129°35.79′W, 19 Jul 1993, 2387 m depth, coll. V. Tunnicliffe, R/S 'ROPOS' dive HYS 221.

*Diagnosis.*—*Asceptrulum* with axial condensation of its farreoid framework.

*Description.*—Size and shape: The single specimen encountered and recorded in situ by video, was broken during collection; about one-half was recovered as four fragments (Fig. 6A). The intact specimen was attached to hard substrate in a region of recently formed basalt blocks sparsely clothed in bacterial mats and strands. Before collection, the organism was frond-like or Y-shaped, 14 cm tall, with a branch point 9 cm from the basal attachment. The four recovered pieces are all thin ribbons or blades with clear axial thickening, thin mar-

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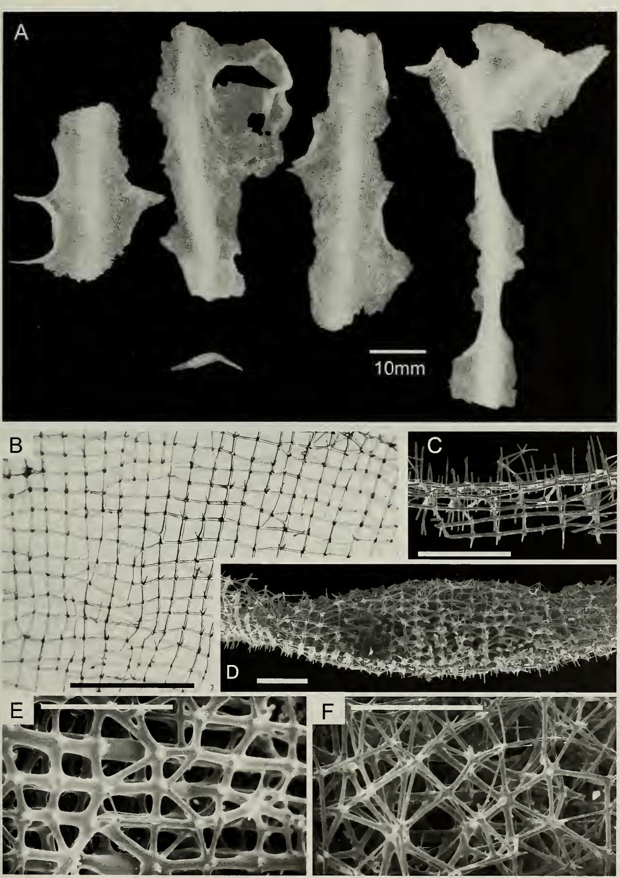
Fig. 6. *Asceptrulum axialis,* new genus, new species, body form and framework of holotype USNM 1001604. A. Body form of recovered fragments with cross-section of one fragment. B. Frontal view of single-layer primary framework in marginal area (LM). C. Same in slightly oblique transverse view showing long, straight spurs




(SEM). D. Cross-section of axial region of blade, atrial surface down, with longitudinal primary strands seen at extreme left (SEM). E. Atrial surface of axial region showing thickened primary longitudinal strands (SEM). F. Dermal surface of same (SEM). Scale bars of B–F = 0.5 mm.

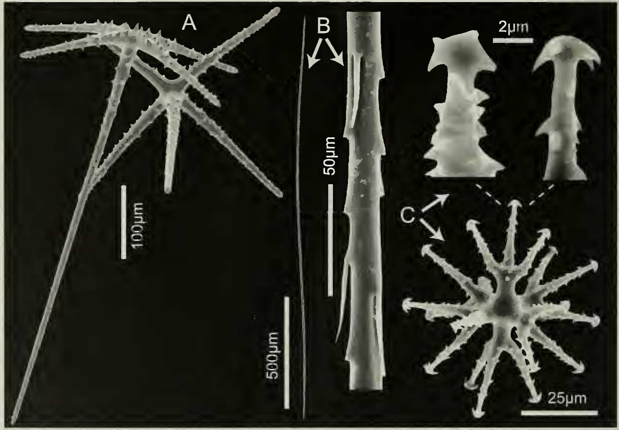



Fig. 7. *Asceptrulum axialis,* new genus, new species, spicules of holotype USNM 1001604 (SEM). A. Surface pentactins. B. Uncinate, whole and magnified segment. C. Discohexaster with magnified ray tips.

ginal fringes with low-amplitude undulation or ruffles. At one point the curved lateral margins are extended and undergo self-fusion resulting in a short lateral tube 1.4 cm in diameter. Intact areas of blades are 9.2–26.2 mm wide and 1.63 ± 0.32 mm (range 0.86–1.88 mm, n = 10) thick at axis centers.

Framework (Fig. 6, Table 3): The primary framework is a typical farreoid one-layer, two-dimensional mesh of smooth beams (Figs. 6B, C) most obvious in the marginal areas. Blade thickness increases gradually toward the axis by addition of up to nine layers of secondary dictyonalia in irregular arrangement on one side, assumed dermal, of the primary framework (Fig. 6D). On the two surfaces of the blade axes, beams are twice as thick on the atrial side with exposed old primary frame (Fig. 6E), 81.3 ± 31.2 µm (range 54–134 µm, n = 5), than on the dermal side (Fig. 6F), 41.1 ± 14.8 µm (range 28.0–64.5 µm, n = 5). Small hexactins fused to framework beams are present but sparse. Spurs of the primary frame are long and straight on both surfaces (Fig. 6C), but while those on the atrial side are rough, those of the dermal side are smooth and often extended and variable in texture. Many of the dermal spurs are fused to centres of secondary dictyonalia or tips of their rays. The secondary structures are a mixture of true and false nodes, with connections occurring between grid levels by synapticula. Channelization is absent.

Spicules (Fig. 7, Table 3): The species has both low diversity and density of loose spicules. Megascleres consist of large, robust pentactins (Fig. 7A) and long, thin uncinates (Fig. 7B). Pentactins, present on dermal and gastral surfaces, have tangential rays with heavy spination on outer and lateral surfaces and proximal rays with coarse tubercles on the upper third of the ray and very sparse low spines over the remainder. Uncinates are typical with well-developed barbs, brackets, and no detectable central tyle. The only microsclere type is a relatively scarce, robust discohexaster (Fig. 7C), distributed evenly throughout the wall. The six primary rays are short, thick and smooth, each supporting three heavily spined secondary rays which end in hemispherically arched discs bearing 5–6 recurved marginal spines.

*Etymology*.—The species name, *axialis*, is originally derived from Latin *axis* = rod or pole. It is here formed from the English adjective *axial* to preserve its euphonious spelling and reflect the easily visible, dense, axial skeletal framework. Gender of the species name is neuter.

*Remarks*.—Absence of sceptrules in this specimen cannot be attributed to pathological condition, damage during collection or inadequate sampling of spicules. The specimen was almost certainly alive at collection, with surface pentactins arrayed in the normal rectangular lattice in places. It is extremely unlikely that disease or the collection process would result in loss of only the one spicule type had sceptrules been present. Occasionally sceptrules may be difficult to obtain in very small samples of farreids, but the use of filtration for spicule collection from cm-size fragments has never failed to find scopules. When the first searches for sceptrules in this specimen proved negative, the entire set of fragments was eventually extracted for spicules and examined; not one part of a sceptrule was found. We are very confident that sceptrules were neither lost nor overlooked. They must have been intrinsically absent.

Since sceptrules are lacking in *Asceptrulum*, its assignment to Farreidae rather than Euretidae is based its one-layered farreoid framework as its primary dictyonal skeleton. A farreoid framework (Reid 1964) consists of a two-dimensional primary grid-like scaffold with dictyonalia, fused in parallel longitudinal strands, cross-linked to adjacent strands by tangential rays fused side-to-side, resulting in a grid-like layer of fused framework. It is the single layer, or two-dimensional, character of this structure that is considered by some authors to be distinctive for the family Farreidae. This alternate definition of Farreidae is extremely important for paleontologists, since loose spicules are unavailable in fossil material. Reiswig (2002) did not include the farreoid framework as a diagnostic feature of Farreidae since it is absent in one of its five extant genera, *Sarostegia* Topsent, 1904 (with euretoid framework). He did, however, note that it has historically been an important diagnostic feature, and thus it is included here in the emended diagnosis.

The alternative assignment of *Asceptrulum* to Euretidae is poorly supported by similar overall spiculation (excepting sceptrule) and presence of a farreoid framework in one of its genera, the monospecific genus, *Bathyxiphus* Schulze, 1899. Position of *Bathyxiphus* cannot be used to support assignment of *Asceptrulum* to Euretidae since its (*Bathxiphus*) sceptrule type is not known with complete certainty and its own assignment is both provisional and precarious. Based upon the firm relationship of the farreoid framework with Farreidae, *Asceptrulum* is best assigned to that family.

Within Farreidae, *A. axialis* has no obvious close relatives. Axial thickening of a blade-form body is unknown in the family and absence of oxy-tip microscleres (presence of only disc- or onych-tip forms) is known only in four *Farrea,* all of which have a body form of branching and usually anastomosing tubes: *F. woodwardi* Kent, 1870; *F. sollasi* Schulze, 1886; *F. weltneri* Topsent, 1901; *F. occa polyclavula* Tabachnick, 1988. None of these are likely ancestral forms which could have given rise to *A. axialis* through the one-step loss of sceptrules.

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